

# DRAFT

## STATEMENT OF BASIS CITY OF RIDGEFIELD NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT NO. WA0023272

The purpose of this Statement of Basis is to explain the need to modify the Permit to increase the influent design criteria for average Flow for the maximum month, five-day Biochemical Oxygen Demand (BOD<sub>5</sub>), and Total Suspended Solids (TSS).

### I. GENERAL INFORMATION

- A. Permittee: City of Ridgefield  
116 North Main Street  
Ridgefield, WA 98642
- B. Discharge Location: Lake River  
Latitude: 45° 49' 18" N  
Longitude: -122° 45' 09" W

### II. REQUEST FOR MODIFICATION

On January 12, 2007, the City of Ridgefield requested a permit modification based on an expansion to their wastewater treatment plant. With the addition of a second primary clarifier and other upgrades, the plant is now capable of treating higher flows and loadings than those listed in the City's current NPDES permit. The City initially performed a "re-rating study," but the Department of Ecology (Ecology) requested the City integrate the new design into plans required under Chapter 173-240 Washington Administrative Code (WAC). These newly revised and approved plans form the basis for this modification to the City's NPDES permit and reflect the extra capacity from the recent upgrade. The modification is needed as the Publicly Owned Treatment Works (POTW) is over its presently recognized design capacity for Total Suspended Solids (TSS), and close to its recognized capacity for Biochemical Oxygen Demand (BOD – a measure of organic pollution which is biodegradable at a treatment works).

Modifications made to the permit include higher mass limits for BOD and TSS, new permit limits for ammonia, alkalinity monitoring, a contingency plan for preventing an alkalinity deficit, and increases to the design criteria in Section S4 of the permit. The greater flows resulted in reduced dilution factors, which were estimated based on a recent dye study. The new mixing zone ratios and ambient data were the basis for concentration limits for Total Ammonia as N.

The proposed permit limits are based on:

- A. Phase I improvements the City has already built.
- B. Phase 2 Improvements the City expects to complete in the near future.

#### Current Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Average flow for the maximum month: 0.50 MGD  
BOD<sub>5</sub> loading for maximum month: 1,083 lbs/day  
TSS loading for maximum month: 1,083 lbs/day

### **Proposed Design Criteria**

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

#### Phase 1:

Average flow for the maximum month: 0.70 MGD  
BOD<sub>5</sub> loading for maximum month: 1,240 lbs/day  
TSS loading for maximum month: 1,240 lbs/day  
Ammonia loading for maximum month: 160 lbs/day

#### Phase 2: (Applicable after acceptance of the Declaration of Completion of Construction of Water Pollution Control Facilities for Phase 2.)

Average flow for the maximum month: 1.0 MGD  
BOD<sub>5</sub> loading for maximum month: 1,348 lbs/day  
TSS loading for maximum month: 1,348 lbs/day  
Ammonia loading for maximum month: 225 lbs/day

### **Comparison of Modified Permit Limits With the Permit Issued December 12, 2003**

Permit limits from the May 4, 2004, permit:

EFFLUENT LIMITATIONS <sup>a</sup> : OUTFALL # 001		
Parameter	Average Monthly	Average Weekly
Biochemical Oxygen Demand <sup>b</sup> (5 day)	30 mg/L 125 lbs/day 85 percent removal	45 mg/L 188 lbs/day
Total Suspended Solids <sup>b</sup>	30 mg/L 125 lbs/day 85 percent removal	45 mg/L 188 lbs/day
Fecal Coliform Bacteria	100/100 mL	200 /100 mL
pH <sup>c</sup>	Daily minimum is equal to or greater than 6 and the daily maximum is less than or equal to 9.	
<sup>a</sup> The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.		

<sup>b</sup> The average monthly effluent concentration for BOD<sub>5</sub> and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.

<sup>c</sup> Indicates the range of permitted values. The instantaneous maximum and minimum pH shall be reported monthly.

Proposed Permit Limits for the Modified Permit:

<b>PHASE 1<sup>e</sup> EFFLUENT LIMITATIONS<sup>a</sup>: OUTFALL # 001</b>		
<b>Parameter</b>	<b>Average Monthly</b>	<b>Average Weekly</b>
Biochemical Oxygen Demand <sup>b</sup> (5 day)	30 mg/L 175 lbs/day 85 percent removal	45 mg/L 263 lbs/day
Total Suspended Solids <sup>b</sup>	30 mg/L 175 lbs/day 85 percent removal	45 mg/L 263 lbs/day
Fecal Coliform Bacteria	200/100 mL	400 /100 mL
pH <sup>c</sup>	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
<b>Parameter</b>	<b>Average Monthly</b>	<b>Maximum Daily<sup>d</sup></b>
Total Ammonia (as N)	1.4 mg/L 8.2 lbs/day	3.14 mg/L
<sup>a</sup> The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.		
<sup>b</sup> The average monthly effluent concentration for BOD <sub>5</sub> and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.		
<sup>c</sup> Indicates the range of permitted values. When pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed seven hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.		
<sup>d</sup> The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.		
<sup>e</sup> Phase 1 limits apply until the first of the month following receipt of the declaration triggering Phase 2 limits (footnote 'e' in the following table.		

<b>PHASE 2<sup>c</sup> EFFLUENT LIMITATIONS<sup>a</sup>: OUTFALL # 001</b>		
<b>Parameter</b>	<b>Average Monthly</b>	<b>Average Weekly</b>
Biochemical Oxygen Demand <sup>b</sup> (5 day)	30 mg/L 202 lbs/day 85 percent removal	45 mg/L 303 lbs/day
Total Suspended Solids <sup>b</sup>	30 mg/L 202 lbs/day 85 percent removal	45 mg/L 303 lbs/day
Fecal Coliform Bacteria	200/100 mL	400 /100 mL
pH <sup>c</sup>	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
<b>Parameter</b>	<b>Average Monthly</b>	<b>Maximum Daily<sup>d</sup></b>
Total Ammonia (as N)	1.2 mg/L 10 lbs/day	2.9 mg/L
<sup>a</sup> The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.		
<sup>b</sup> The average monthly effluent concentration for BOD <sub>5</sub> and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.		
<sup>c</sup> Indicates the range of permitted values. When pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed seven hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.		
<sup>d</sup> The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.		
<sup>e</sup> Phase 2 limits apply on the first day of the month following the receipt by the Department of Ecology of a properly completed Declaration of Completion of Construction of Water Pollution Control Facilities (see Chapter 173-240 WAC for format) for the facilities described in the approved Facility Plan as Phase 2 improvements.		

### **Dilution Factors**

The new dilution factors were calculated as follows:

- A dye study was performed and a model calibrated to yield ambient concentrations at the edges of the acute and chronic boundaries at various flow rates. The reflux was calculated based on information from the study.

- Old average flow for the maximum month flow = 0.5 MGD, and the new proposed average flow for the maximum month = 0.7 MGD (Peak day – 1.2 MGD at this rate)
- Critical stream flows for both wet and dry seasons are 200 cfs.
- Seasonally differentiated limits are therefore not established.

#### **Chronic Zone**

MMA = 0.7 MGD		
Dilution implied by Dye Study:	53.2:1	0.0188
Farfield Concentration:		0.0046
	Total:	0.0234
Effluent Dilution (inverse of conc):		42.7:1

#### **Acute Zone**

Dilution implied by Dye Study:	4.4:1	0.2273
Farfield Concentration:		0.0079
	Total:	0.2352
Effluent Dilution (inverse of concentration)		4.25:1

#### **BOD<sub>5</sub> Concentration and Mass Loading**

For BOD, monthly effluent mass loadings (lbs/day) were calculated, per Ecology's guidance, as the lesser of the required removal at the maximum monthly influent design loading (1,240 lbs/day) x 0.15 = 186 lbs/day and the effluent flow at the maximum concentration (0.7MGD) X 30 mg/L X 8.34 lb/g = 175 lbs/day (monthly average). In this case, the latter criteria dictates the limit.

The weekly average BOD effluent mass loading is calculated as 1.5 x monthly loading (175 lbs/day) = 263 lbs/day (maximum weekly average).

#### **TSS Concentration and Mass Loading**

Limits for Total Suspended Solids (TSS) were derived the same as for BOD limits, and yielded the same values. The more limiting criteria is based on maximum effluent concentration. The limiting loading is the effluent flow at the maximum concentration (0.7MGD) X 30 mg/L X 8.34 lb/g = 175 lbs/day (monthly average).

The weekly average TSS effluent mass loading is calculated as 1.5 x monthly loading = 263 lbs/day.

#### **Total Ammonia as N Concentration Limit**

The following spreadsheets were used to calculate the total ammonia as N concentration limit.

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Based on Lotus File NH3FRES2.WK1 Revised 12-Dec-94

Notes: City of Ridgefield August 2007 Permit Modification

### INPUT

1. Temperature (deg C; 0<T<30): 90th%-tile	24.1
2. pH (6.5<pH<9.0): 90th%-tile	8.84
3. Total Ammonia (ug N/L):	
4. Acute TCAP (Salmonids present- 20; absent- 25):	20
5. Chronic TCAP (Salmonids present- 15; absent- 20):	15

### OUTPUT

1. Intermediate Calculations:	
Acute FT:	1.0000
Chronic FT:	1.4125
FPH:	1.0000
RATIO:	13.5000
pKa:	9.2726
Fraction Of Total Ammonia Present As Un-ionized:	26.9730%
2. Sample Un-ionized Ammonia Concentration (ug/L as NH3-N):	0
3. Un-ionized Ammonia Criteria:	
Acute (1-hour) Un-ionized Ammonia Criterion (mg/L as NH3-N):	0.21372
Chronic (4-day) Un-ionized Ammonia Criterion (mg/L as NH3-N):	0.034484826
4. Total Ammonia Criteria:	
Acute Total Ammonia Criterion (mg/L as NH3-N):	0.79
Chronic Total Ammonia Criterion (mg/L as NH3-N):	0.13

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Water Quality-Based Permit Limits for Acute and Chronic Criteria.  
(based on EPA/505/2-90-001 Box 5-2).

Based on Lotus File WQBP2.WK1 Revised 19-Oct-93

Notes: City of Orting January 2007 Permit Modification

**INPUT**

1. Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	<b>0.79</b>
Chronic (n-day) Criteria:	<b>0.13</b>
2. Upstream Receiving Water Concentration	
Upstream Concentration for Acute Condition (7Q10): 95th%-tile	<b>0.07</b>
Upstream Concentration for Chronic Condition (7Q10): 90th%-tile	<b>0.07</b>
3. Dilution Factors (1/{Effluent Volume Fraction}) or Plumes Model	
Acute Receiving Water Dilution Factor:	<b>4.3</b>
Chronic Receiving Water Dilution Factor:	<b>43</b>
4. Coefficient of Variation for Effluent Concentration (0.6 or a calculated CV if there are more than 10 data points):	<b>0.600</b>
5. Number of days (n1) for chronic average (usually four or seven; four is recommended):	<b>7</b>
6. Number of samples (n2) required per month for monitoring:	<b>8</b>

**OUTPUT**

1. Z Statistics	
LTA Derivation (99%tile):	2.326
Daily Maximum Permit Limit (99%tile):	2.326
Monthly Average Permit Limit (95%tile):	1.645
2. Calculated Waste Load Allocations (WLA's)	
Acute (one-hour) WLA:	3.139
Chronic (n1-day) WLA:	2.547
3. Derivation of LTAs using April 1990 TSD (Box 5-2 Step 2 & 3)	
Sigma^2:	0.3075
Sigma^2-n1:	0.0501
LTA for Acute (1-hour) WLA:	1.008
LTA for Chronic (n1-day) WLA:	1.551
Most Limiting LTA (minimum of acute and chronic):	1.008
4. Derivation of Permit Limits From Limiting LTA (Box 5-2 Step 4)	
Sigma^2-n2:	0.0440
Daily Maximum Permit Limit:	<b>3.139</b>
Monthly Average Permit Limit:	<b>1.392</b>

**Total Ammonia as N Mass Load Limit**

Maximum Daily Load Limit = 0.7 MGD x 1.4 mg/L x 8.34 = lbs/day

**Proposed Monitoring Requirements:** The monitoring below is also added with a narrative contingency requirement that is triggered by low pH or low alkalinity. See the below section “Alkalinity Monitoring and Response Plan” for the rationale for this change.

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent	Total Ammonia as N	mg/L lbs/day	Influent at Headworks past the screening	2/week	Grab
Wastewater Effluent	Total Ammonia as N	mg/L lbs/day	Effluent past the weir	2/week	Grab
Wastewater Effluent	Alkalinity	mg/L as CaCO <sub>3</sub>	Effluent past the weir	2/week	24-hour Composite

**Alkalinity Monitoring and Response Plan** – Below is a summary of Ecology’s confirmatory analysis of the approved design with a 30 percent factor of safety. This analysis used the design formulas and sizing methodology found in Metcalf & Eddy 4<sup>th</sup> International Edition, and the component sizes from the facility plan. Note that this analysis shows that there will be an alkalinity deficit of some 852 lbs/day. While some amount of denitrification can reduce the need for alkalinity addition, the POTW’s basins are not optimized for denitrification, and are designed to be entirely oxic (no anoxic zones). The only anoxic zones are in the contact basin, but the contact time there is too short at the design flows to reliably denitrify. Therefore, it would be imprudent to expect a high degree of denitrification at design conditions, and an alkalinity deficit must be anticipated. For this reason, the Permittee is being required to sample for alkalinity, and to respond if the alkalinity drops below 70 mg/L (or pH drops below 6.0) by constructing and using an alkalinity addition system. This lower limit (70 mg/L) is the lowest level considered “safe” by good practice. A lower alkalinity concentration has a high likelihood of causing the pH to drop to 6.0 or below and also result in an “upset” of the treatment plant’s biological processes.

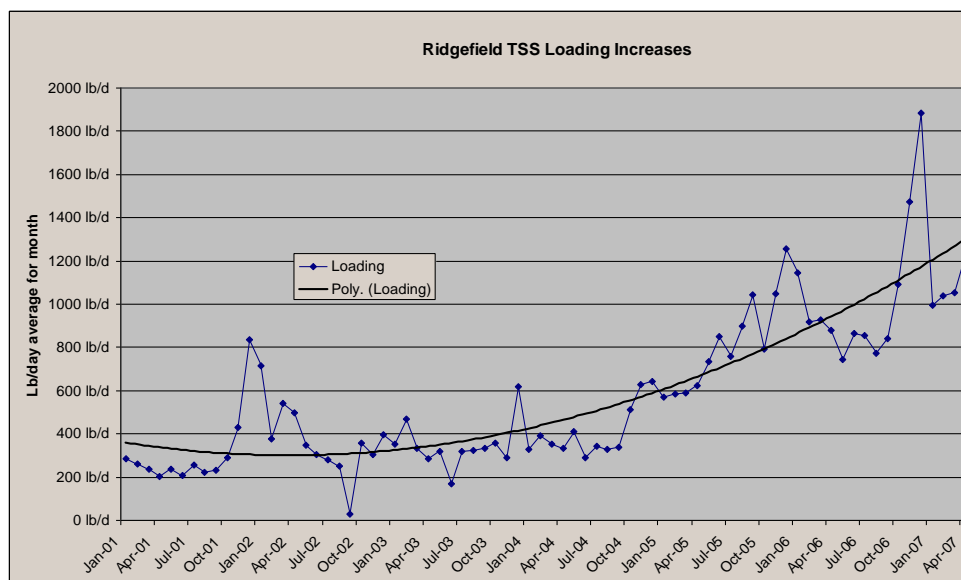
DESIGN SUMMARY	English Units
PARAMETER:	(Nitrifying)
Average wastewater flow	.70 MGD
Average BOD load	1,236. lb/d
Average NH <sub>3</sub> &4 - N load	210. lb/d
Aerobic SRT	7.1 days
Aeration basins	2 each
Aeration tank vol ea	.178 MG



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DESIGN SUMMARY	English Units
PARAMETER:	(Nitrifying)
Hydraulic detention time	12 hours
MLSS	3000 mg/l
MLVSS	2292 mg/l
F:M	0.18 :1
BOD Loading	<b>32.4 lb/1000cf</b>
Sludge Production	1,256. lb/d
Observed Yield	1.02 lb/lb
Oxygen Required	93. lb/hr
Air Flowrate (ave)	<b>676. scfm</b>
RAS ratio	0.60
Clarifier overflow rate	<b>393. gpd/sf</b>
Alkalinity needed (CaCO <sub>3</sub> )	<b>852. lb/d</b>
Effluent BOD	9.0 mg/l
Effluent TSS	10.0 mg/l
Effluent Ammonia (NH <sub>4</sub> -N)	0.9 mg/l

**Need For Permit Modification:** The City of Ridgefield already has a service need for the additional capacity gained through their recently completed construction and this permit modification. The below analysis shows how TSS loadings have increased over time. The curve which follows the average loading to the POTW up to the present already intersects the new (Phase 1) capacity (1,240 lbs/day).



This Statement of Basis will serve as an amendment to the fact sheet and permit.